FIG. 1

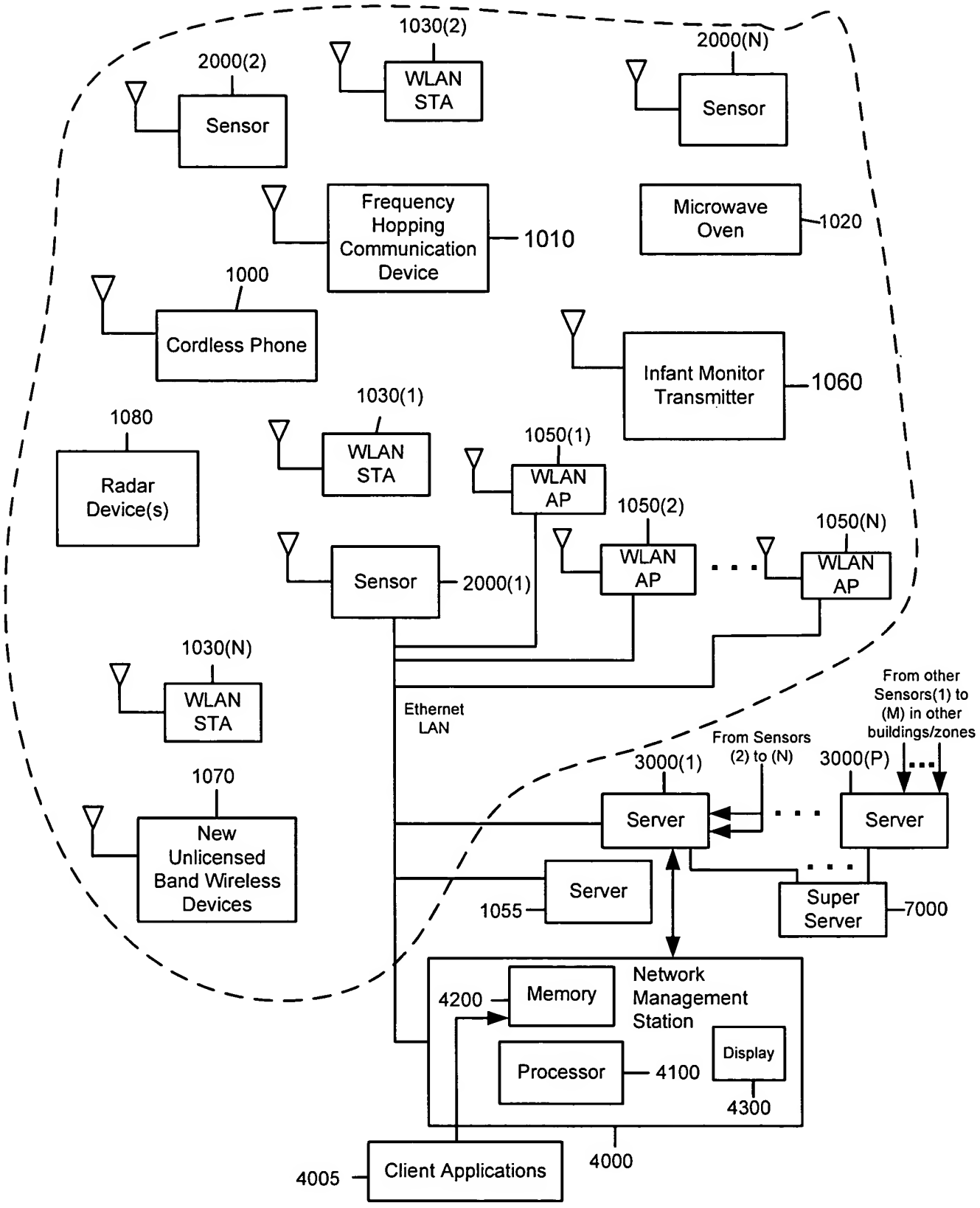

1030(2)
WLAN STA
2000(2)
Sensor
2000(N)
Sensor
Frequency Hopping Communication Device
1010
Microwave Oven
1020
1000
Cordless Phone
Infant Monitor Transmitter
1060
1030(1)
WLAN STA
1080
Radar Device(s)
1050(1)
WLAN AP
1050(2)
WLAN AP
1050(N)
WLAN AP
Sensor
2000(1)
1030(N)
WLAN STA
Ethernet LAN
From other Sensors(1) to (M) in other buildings/zones
From Sensors (2) to (N)
3000(1)
3000(P)
1070
New Unlicensed Band Wireless Devices
Server
Server
Server
1055
Super Server
7000
Network Management Station
4200
Memory
Processor
4100
Display
4300
4000
4005
Client Applications

FIG. 2

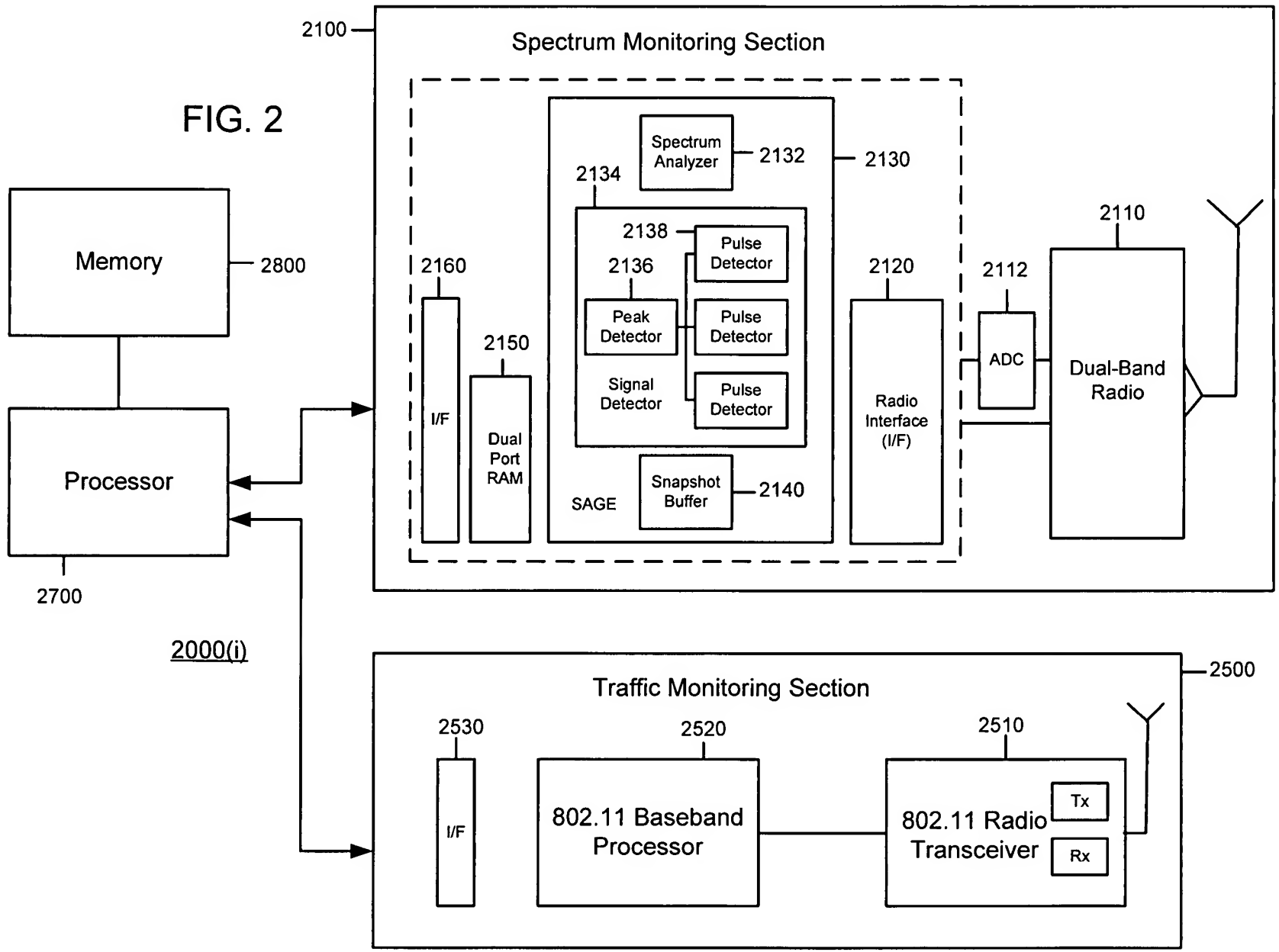
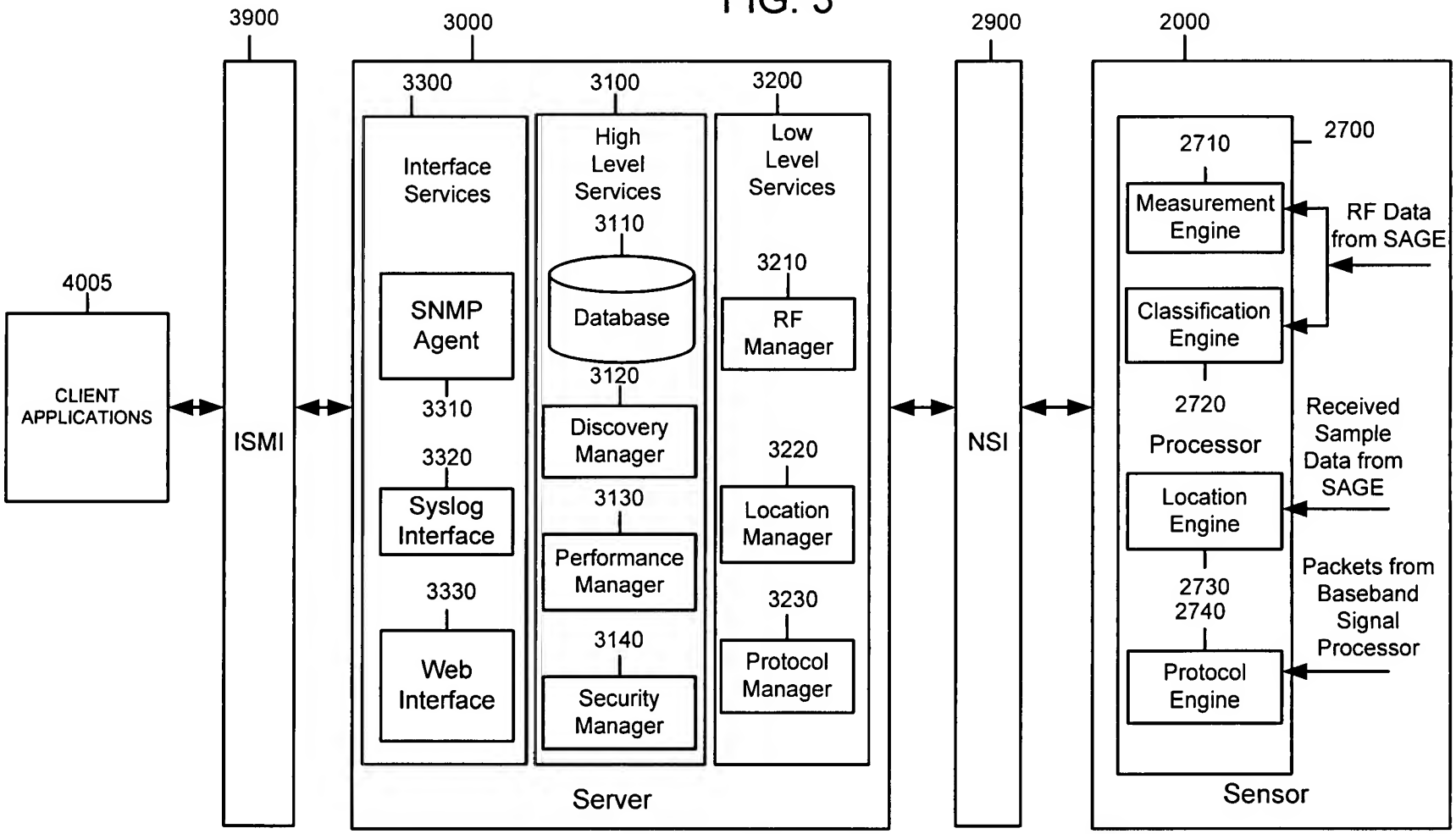

2100
Spectrum Monitoring Section
Memory
2800
Processor
2700
2000(i)
2160
I/F
2150
Dual Port RAM
2130
Spectrum Analyzer
2132
2134
2138
2136
Pulse Detector
Peak Detector
Pulse Detector
Signal Detector
Pulse Detector
SAGE
Snapshot Buffer
2140
2120
Radio Interface (I/F)
2112
ADC
2110
Dual-Band Radio
2500
Traffic Monitoring Section
2530
I/F
2520
802.11 Baseband Processor
2510
802.11 Radio Transceiver
Tx
Rx

FIG. 3


3900
3000
2900
2000
3300
3100
3200
4005
CLIENT APPLICATIONS
ISMI
Interface Services
High Level Services
Low Level Services
3110
3210
SNMP Agent
Database
RF Manager
3120
3310
Discovery Manager
3320
3220
Syslog Interface
Location Manager
3130
Performance Manager
3330
3230
Web Interface
3140
Protocol Manager
Security Manager
Server
NSI
2700
2710
Measurement Engine
RF Data from SAGE
Classification Engine
2720
Processor
Received Sample Data from SAGE
Location Engine
Packets from Baseband Signal Processor
2730
2740
Protocol Engine
Sensor

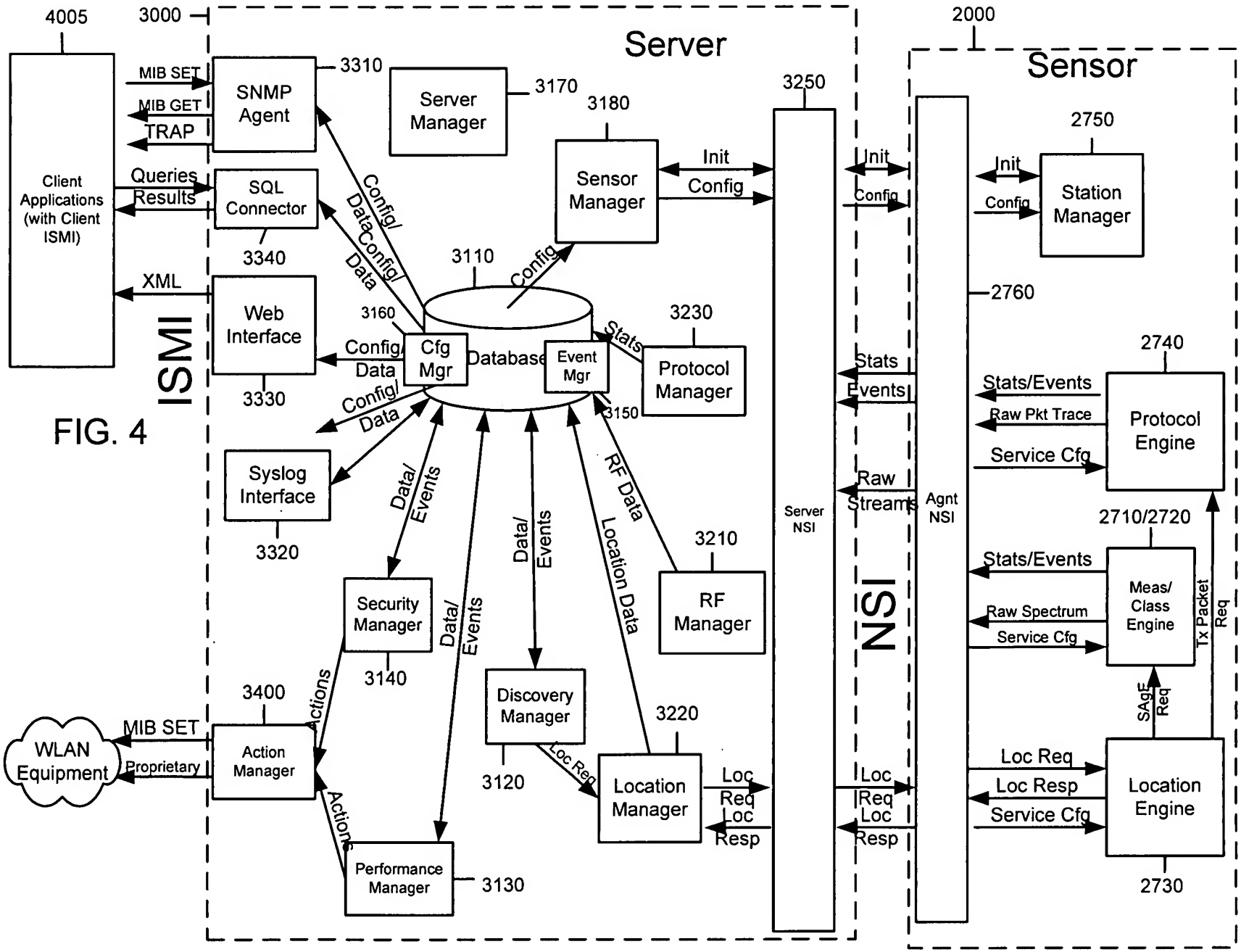

4005
3000
Server
2000
Sensor
Client Applications (with Client ISMI)
ISMI
MIB SET
MIB GET
TRAP
Queries
Results
XML
SNMP Agent
3310
SQL Connector
3340
Web Interface
3330
Syslog Interface
3320
Server Manager
3170
Sensor Manager
3180
Init
Config
Config/ Data
Config/ Data
Config
3110
Database
3160
Cfg Mgr
Event Mgr
3150
Stats
3230
Protocol Manager
Config/ Data
Config/ Data
Data/ Events
Data/ Events
Data/ Events
RF Data
Location Data
Security Manager
3140
Discovery Manager
3120
RF Manager
3210
Location Manager
3220
Actions
Actions
3400
WLAN Equipment
MIB SET
Proprietary
Action Manager
Performance Manager
3130
3250
Server NSI
NSI
Init
Config
Stats
Events
Raw Streams
Loc Req
Loc Resp
Agnt NSI
2750
Station Manager
Init
Config
2760
2740
Protocol Engine
Stats/Events
Raw Pkt Trace
Service Cfg
2710/2720
Meas/ Class Engine
Stats/Events
Raw Spectrum
Service Cfg
Tx Packet Req
SAgE Req
Location Engine
Loc Req
Loc Resp
Service Cfg
2730

FIG. 4

FIG. 5

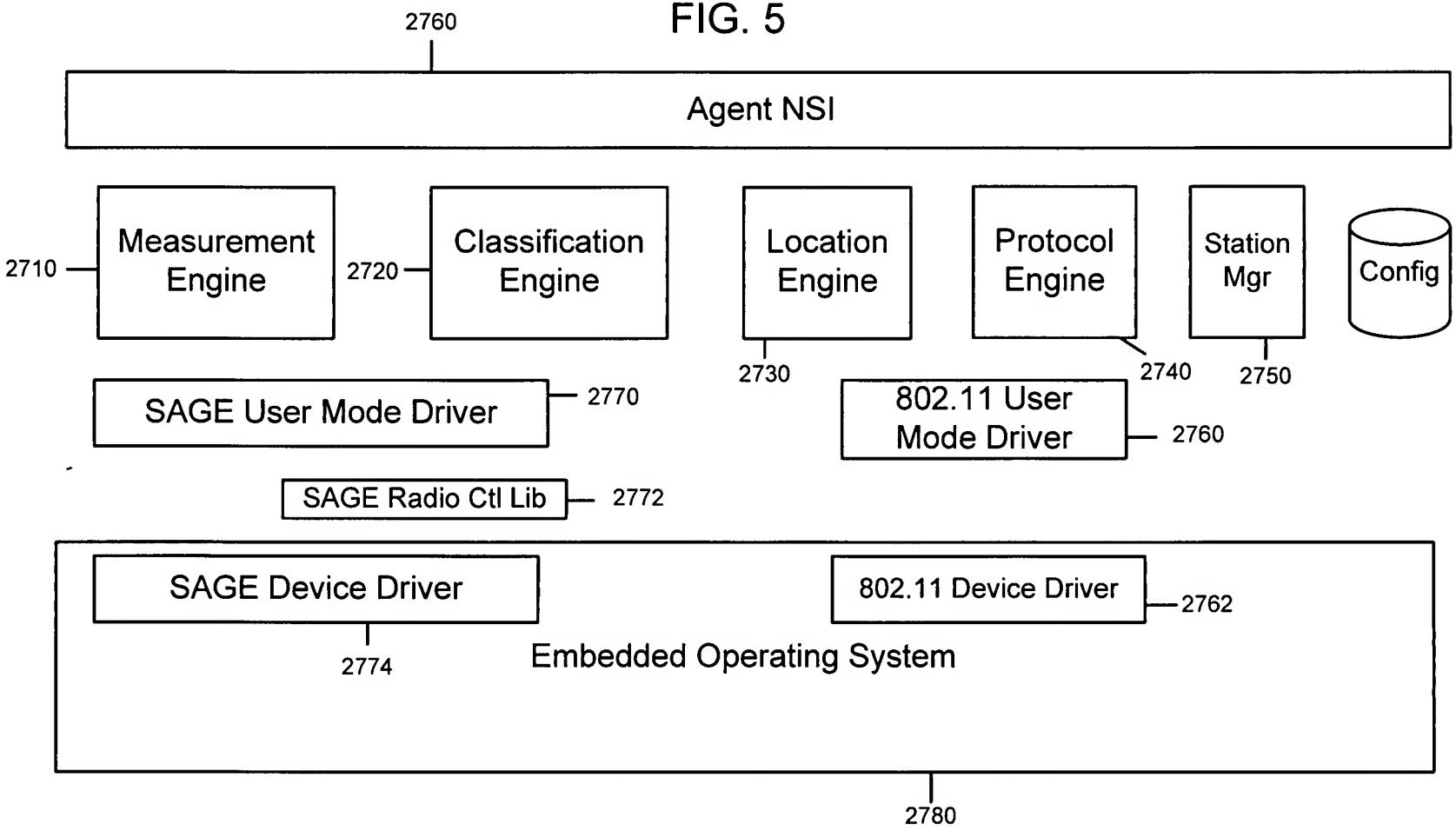
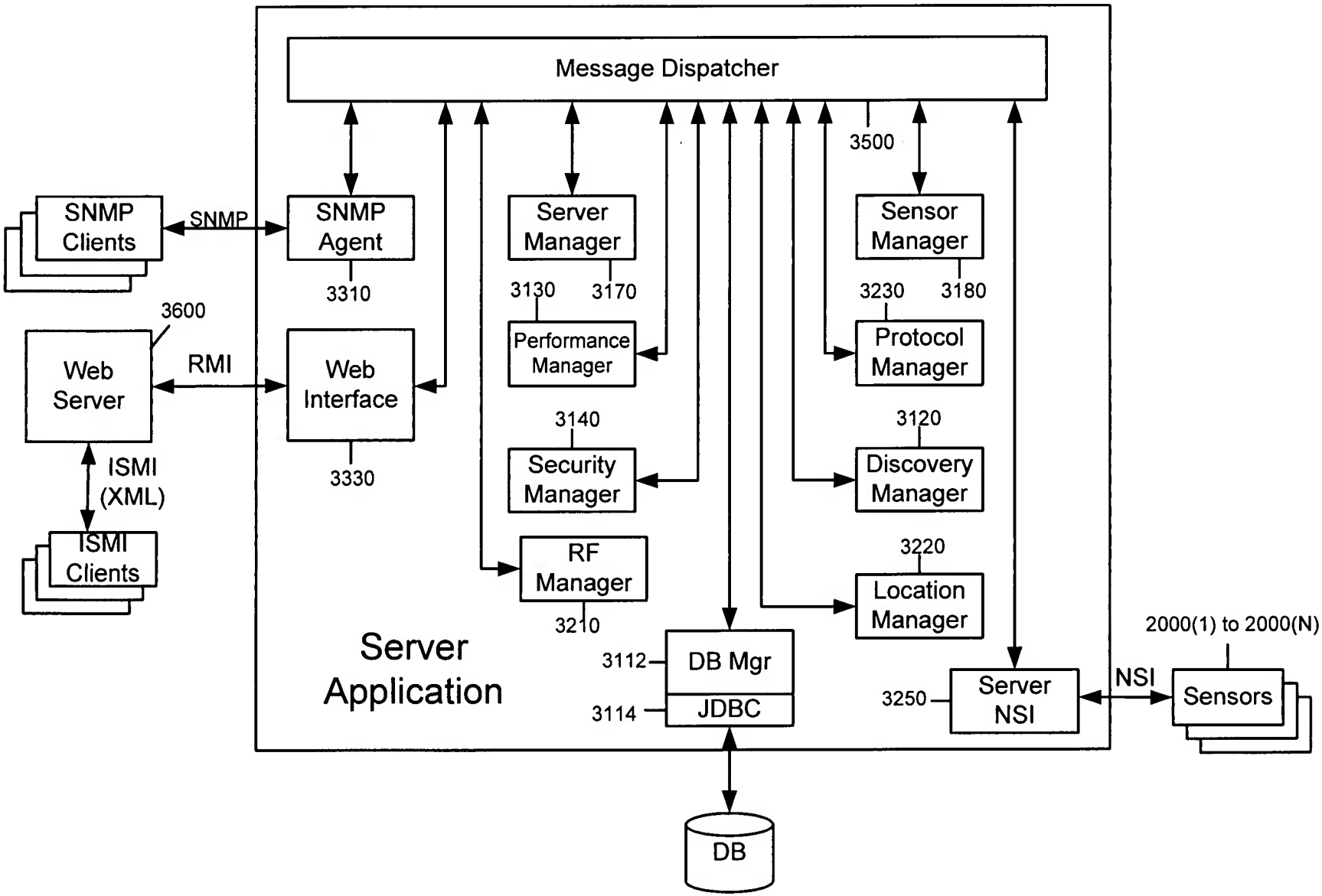

2760
Agent NSI
2710
Measurement Engine
2720
Classification Engine
Location Engine
Protocol Engine
Station Mgr
Config
2730
2740
2750
SAGE User Mode Driver
2770
802.11 User Mode Driver
2760
SAGE Radio Ctl Lib
2772
SAGE Device Driver
802.11 Device Driver
2762
2774
Embedded Operating System
2780

FIG. 6


Message Dispatcher
3500
SNMP Clients
SNMP
SNMP Agent
3310
Server Manager
3130
3170
Performance Manager
Sensor Manager
3230
3180
Protocol Manager
3600
Web Server
RMI
Web Interface
3330
3140
Security Manager
3120
Discovery Manager
ISMI (XML)
ISMI Clients
RF Manager
3210
3220
Location Manager
Server Application
3112
DB Mgr
3114
JDBC
3250
Server NSI
NSI
2000(1) to 2000(N)
Sensors
DB

5000

FIG. 7

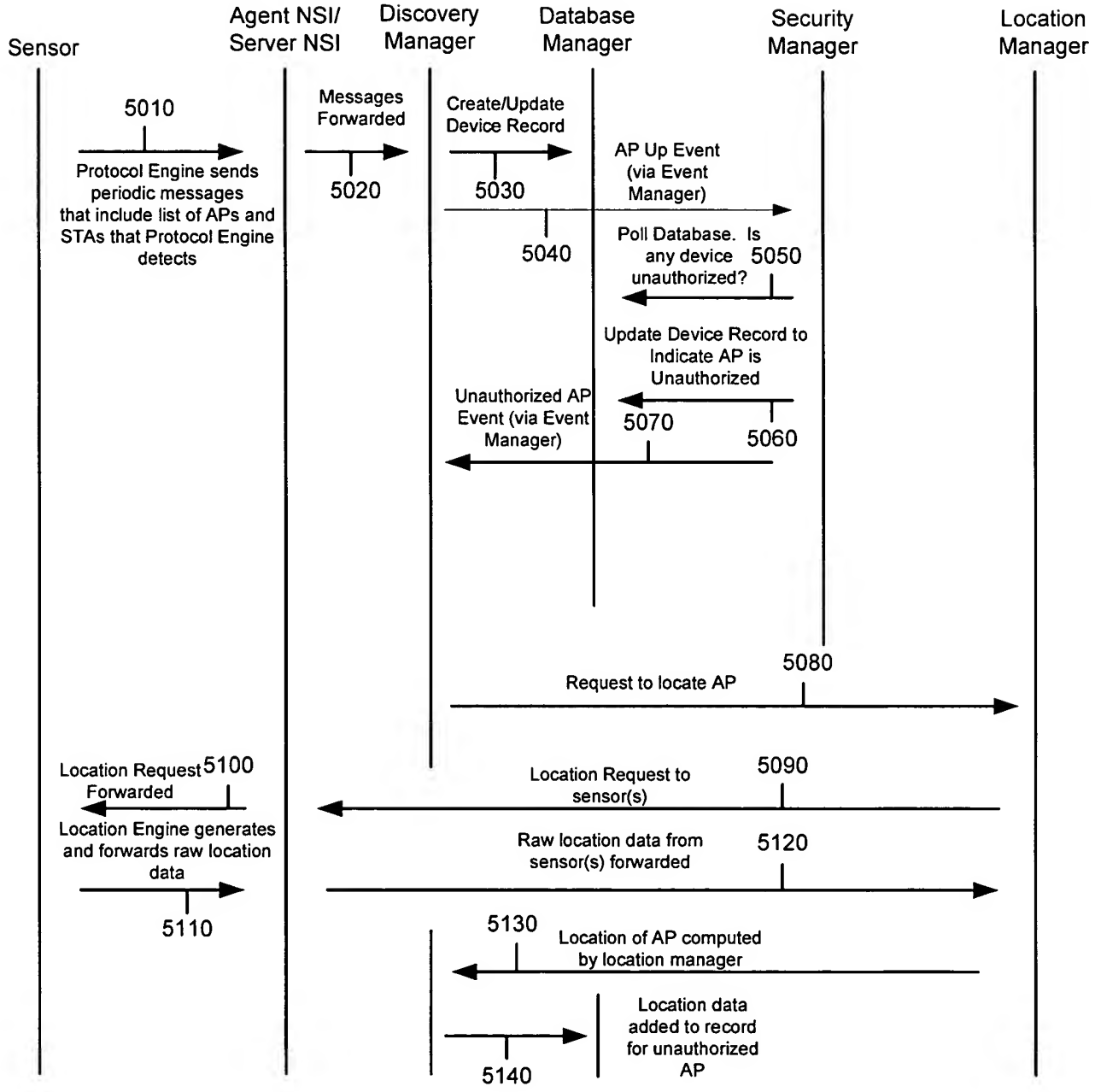

Sensor
Agent NSI/ Server NSI
Discovery Manager
Database Manager
Security Manager
Location Manager
5010
Protocol Engine sends periodic messages that include list of APs and STAs that Protocol Engine detects
Messages Forwarded
5020
Create/Update Device Record
5030
AP Up Event (via Event Manager)
5040
Poll Database. Is any device unauthorized?
5050
Update Device Record to Indicate AP is Unauthorized
5060
Unauthorized AP Event (via Event Manager)
5070
5080
Request to locate AP
Location Request Forwarded
5100
Location Request to sensor(s)
5090
Location Engine generates and forwards raw location data
5110
Raw location data from sensor(s) forwarded
5120
5130
Location of AP computed by location manager
Location data added to record for unauthorized AP
5140

FIG. 8

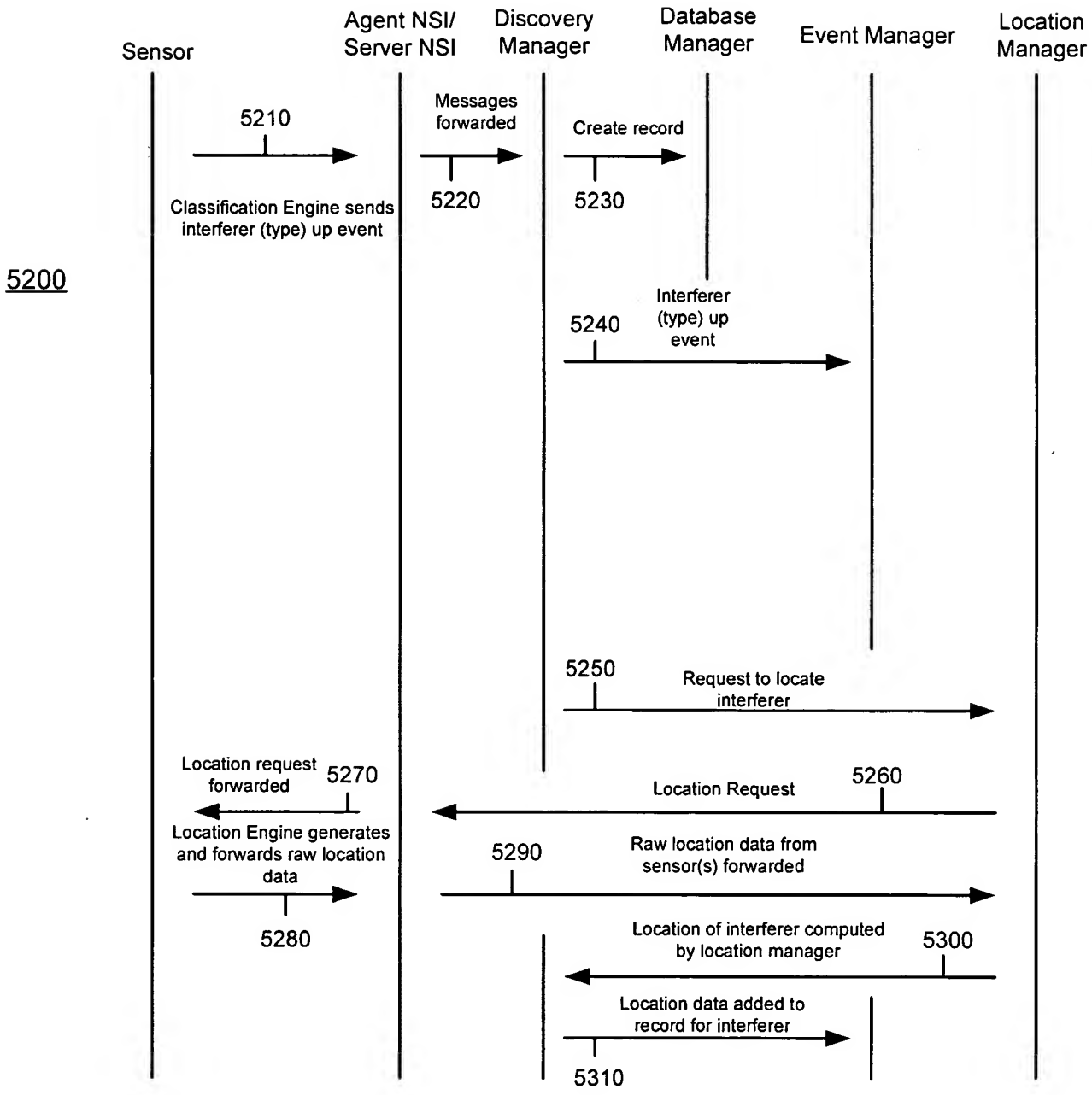

5200
Sensor
Agent NSI/ Server NSI
Discovery Manager
Database Manager
Event Manager
Location Manager
5210
Classification Engine sends interferer (type) up event
Messages forwarded
5220
Create record
5230
Interferer (type) up event
5240
5250
Request to locate interferer
Location request forwarded
5270
Location Request
5260
Location Engine generates and forwards raw location data
5280
5290
Raw location data from sensor(s) forwarded
Location of interferer computed by location manager
5300
Location data added to record for interferer
5310

FIG. 9

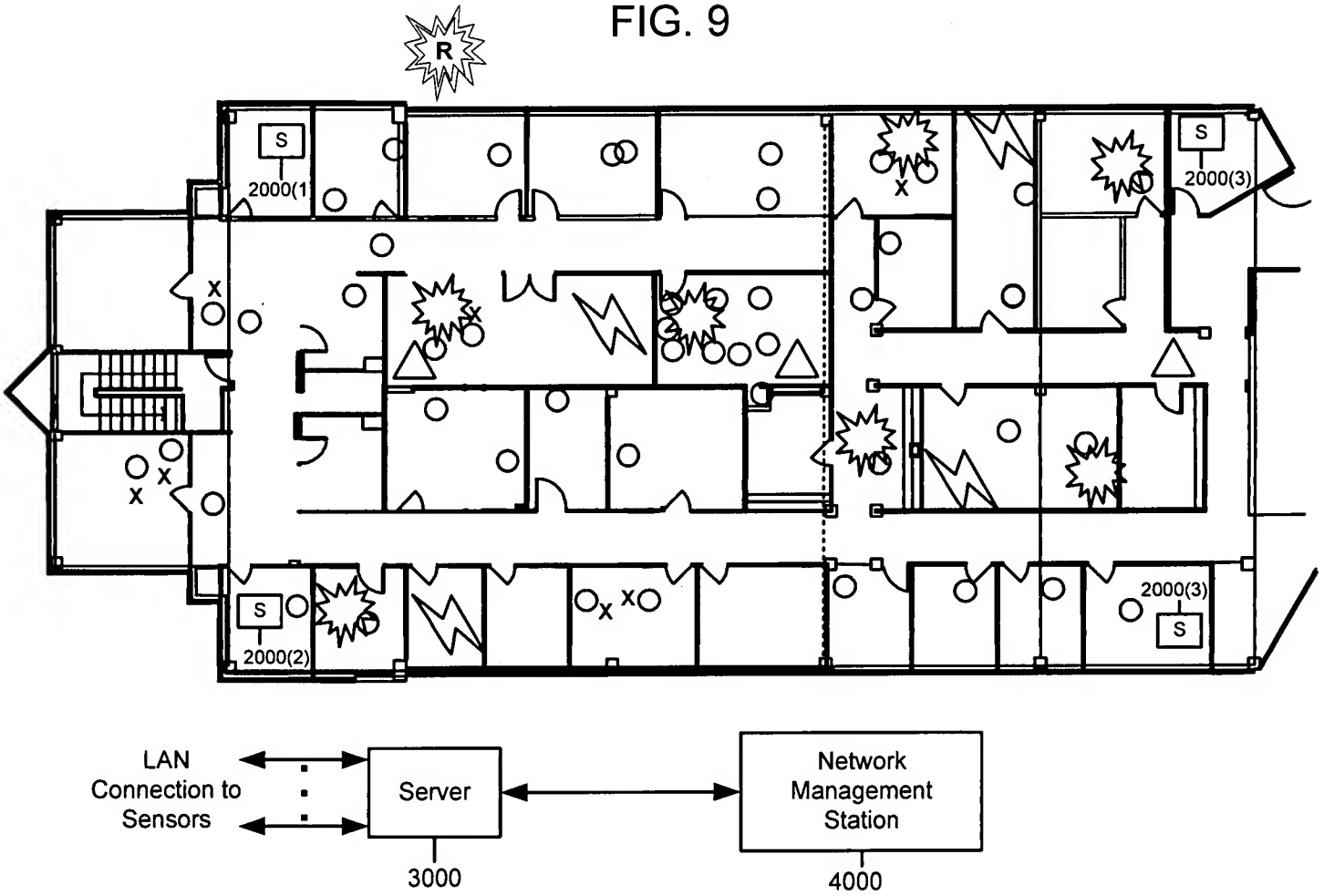

R
S
2000(1
S
2000(3)
X
X
X
X
S
2000(2)
X
X
2000(3)
S
LAN
Connection to
Sensors
Server
3000
Network
Management
Station
4000
AP
STA
S
Sensor
X
No Coverage
Interfering Device
R
Possible Rogue Element
Network is Experiencing
Interference

FIG. 10

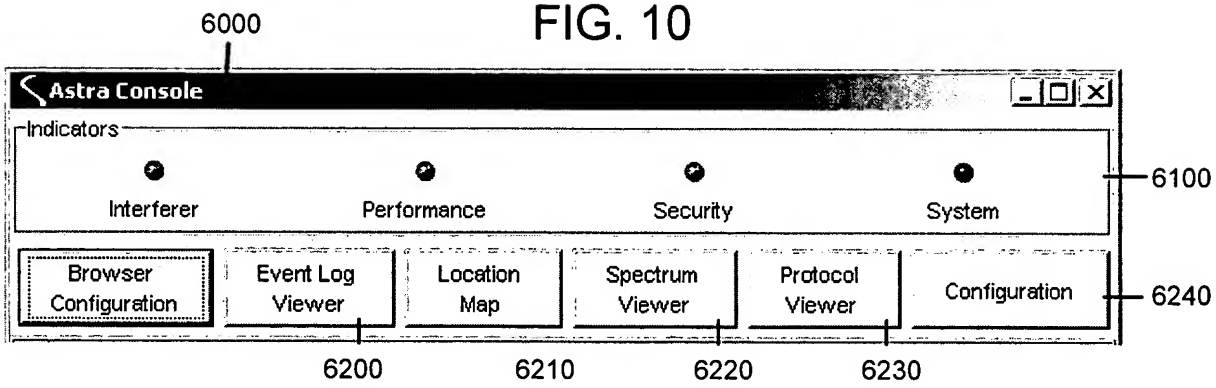


FIG. 11

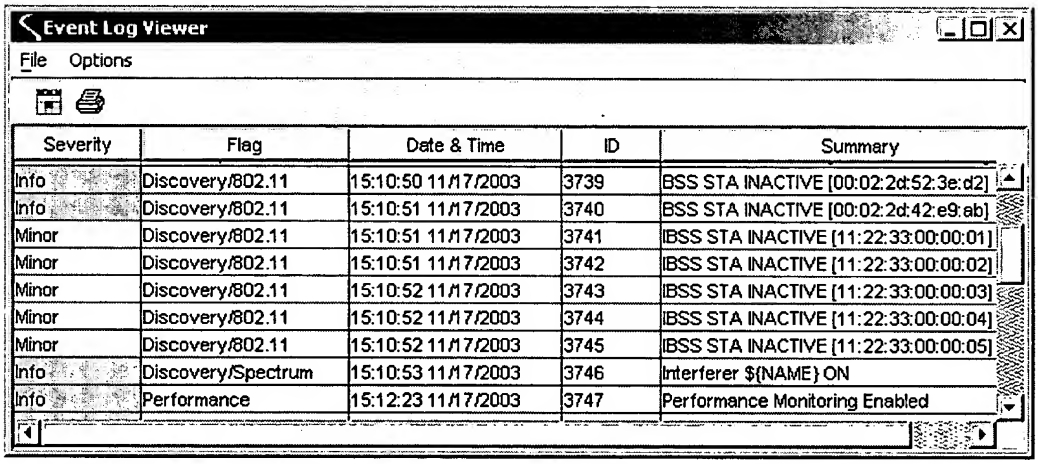


FIG. 12

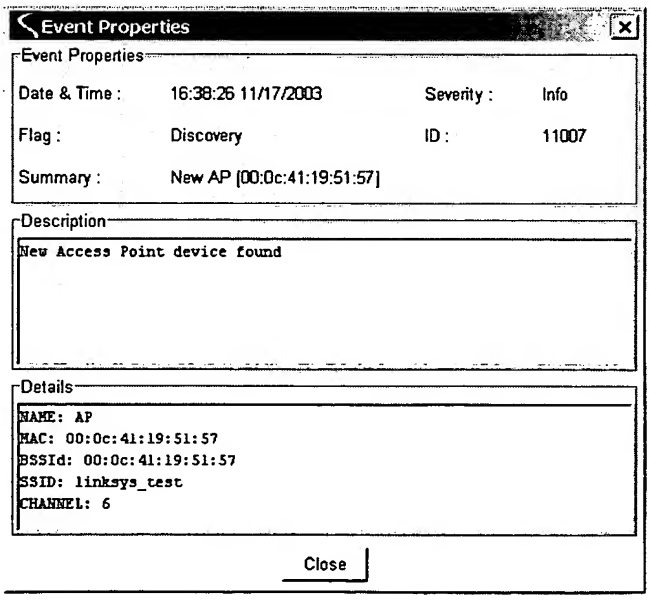


FIG. 13

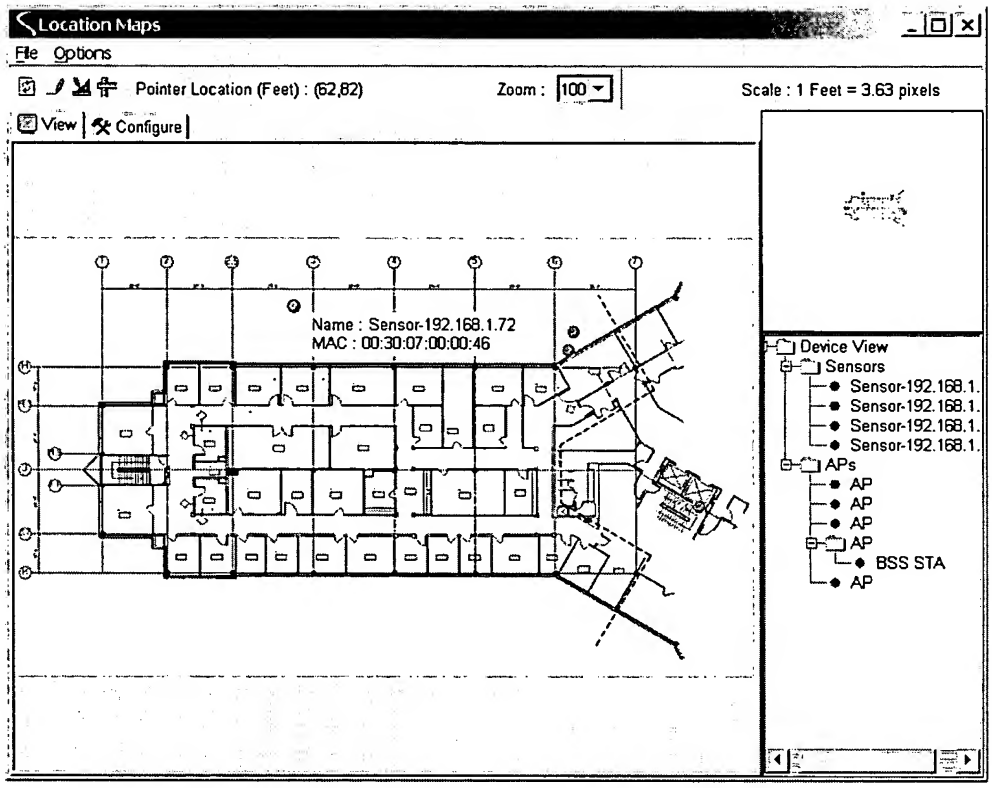

Location Maps
File Options
Pointer Location (Feet) : (62,82)
Zoom : 100
Scale : 1 Feet = 3.63 pixels
View
Configure
Name : Sensor-192.168.1.72
MAC : 00:30:07:00:00:46
Device View
Sensors
Sensor-192.168.1.
Sensor-192.168.1.
Sensor-192.168.1.
Sensor-192.168.1.
APs
AP
AP
AP
AP
BSS STA
AP

FIG. 14

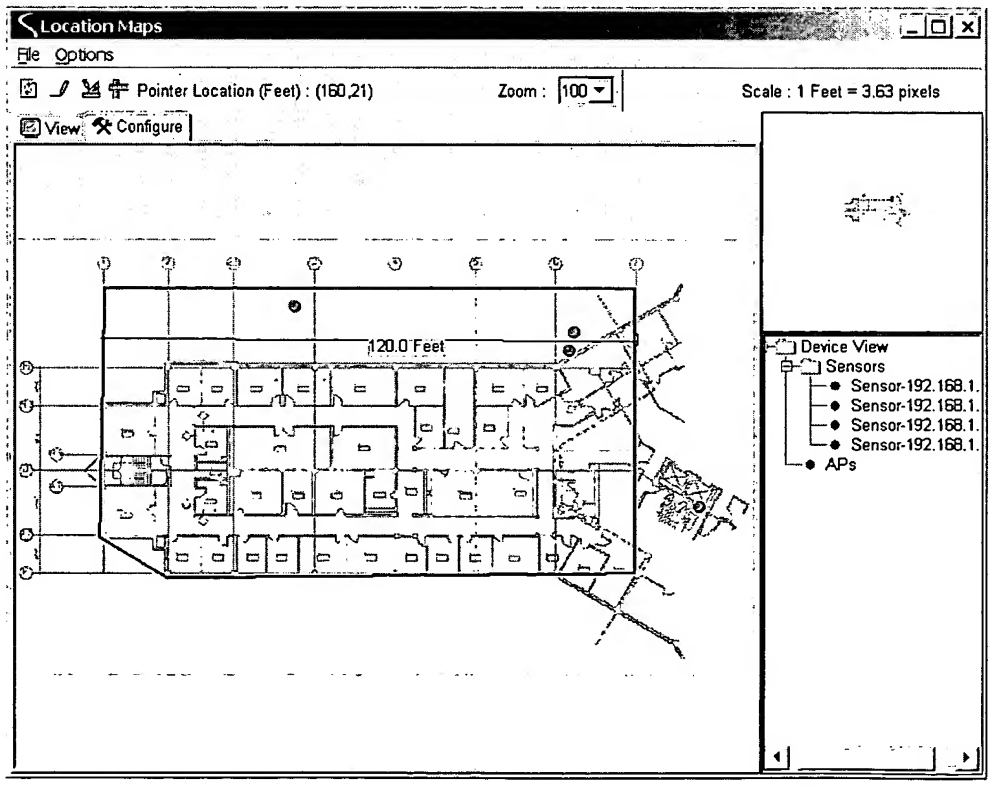

Location Maps
File Options
Pointer Location (Feet) : (160,21)
Zoom : 100
Scale : 1 Feet = 3.63 pixels
View
Configure
120.0 Feet
Device View
Sensors
Sensor-192.168.1.
Sensor-192.168.1.
Sensor-192.168.1.
Sensor-192.168.1.
APs

FIG. 15

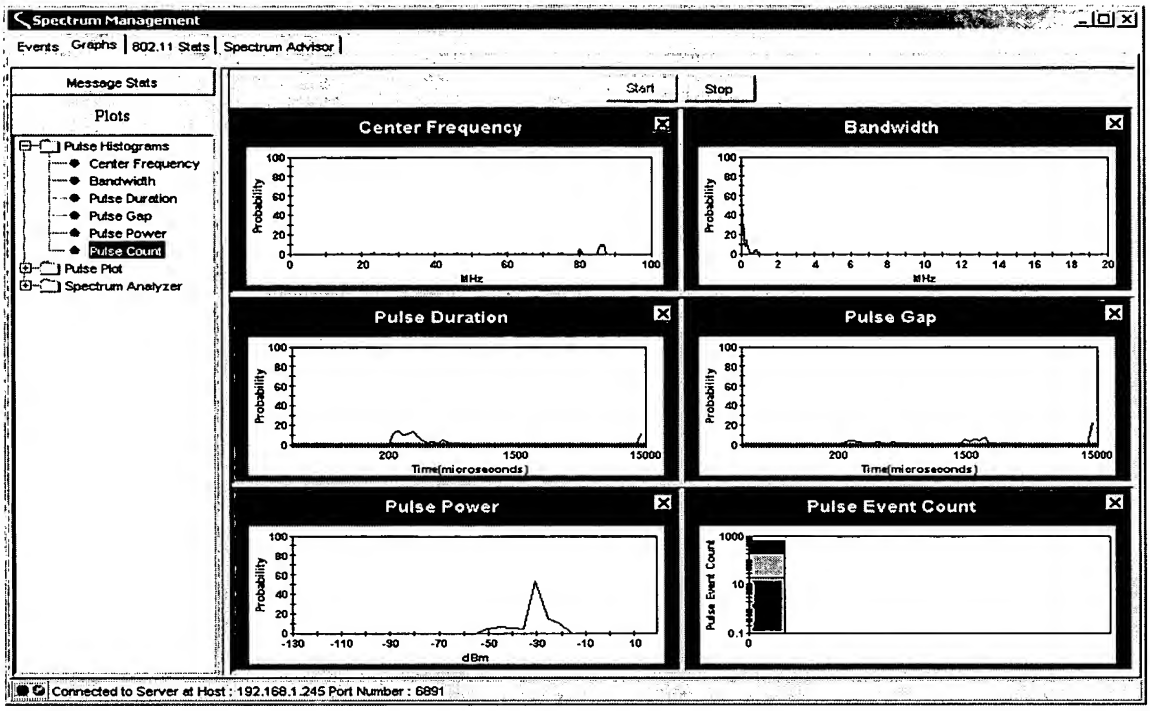

Spectrum Management
Events
Graphs
802.11 Stats
Spectrum Advisor
Message Stats
Plots
Pulse Histograms
Center Frequency
Bandwidth
Pulse Duration
Pulse Gap
Pulse Power
Pulse Count
Pulse Plot
Spectrum Analyzer
Start
Stop
Center Frequency
Bandwidth
Pulse Duration
Pulse Gap
Pulse Power
Pulse Event Count
Probability
MHz
Time(microseconds)
dBm
Pulse Event Count
Connected to Server at Host : 192.168.1.245 Port Number : 6891

FIG. 16

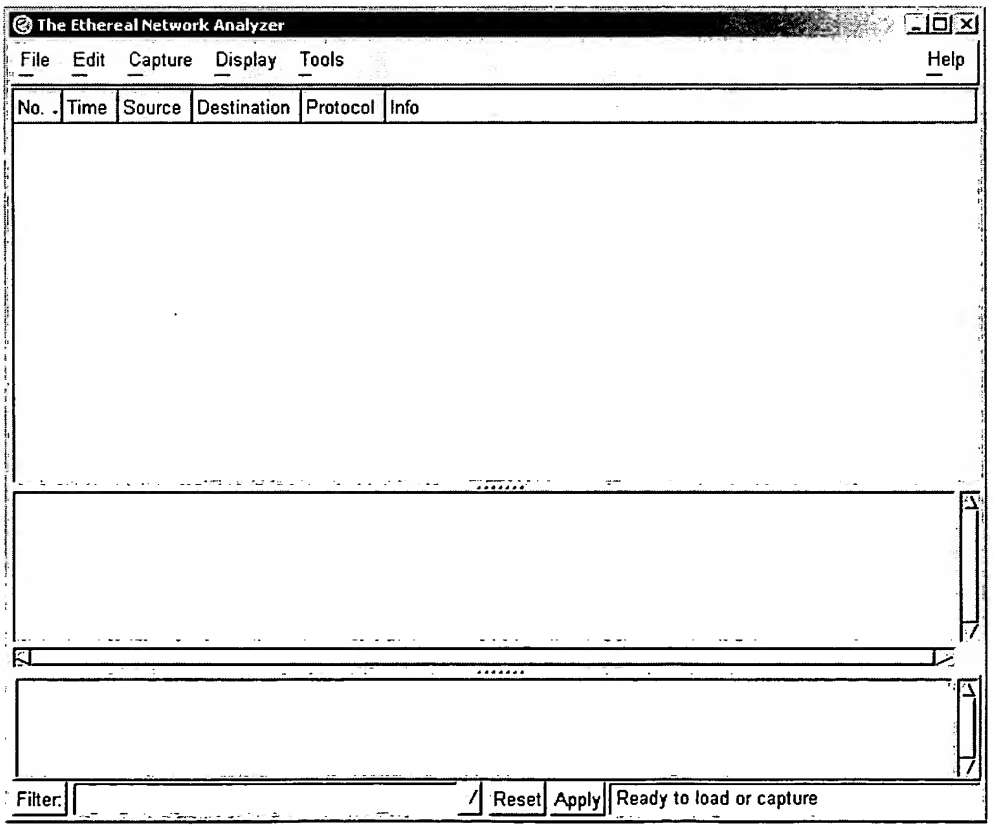
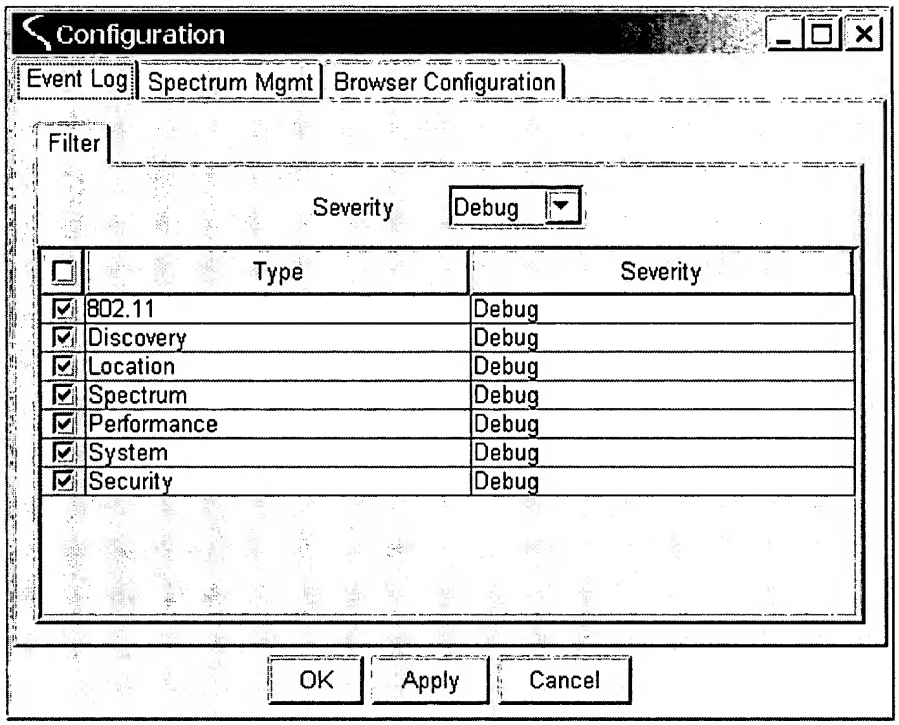

The Ethereal Network Analyzer
File
Edit
Capture
Display
Tools
Help
No.
Time
Source
Destination
Protocol
Info
Filter:
Reset
Apply
Ready to load or capture

FIG. 17


Configuration
Event Log
Spectrum Mgmt
Browser Configuration
Filter
Severity
Debug
Type
Severity
802.11
Debug
Discovery
Debug
Location
Debug
Spectrum
Debug
Performance
Debug
System
Debug
Security
Debug
OK
Apply
Cancel